

## SURROUND SOUND LOUDSPEAKER SYSTEM

### Abstract.

The generation of skewed hypercardioid sound energy fields (in polar diagrams) from right front and left front "surround" loudspeakers with the principal nulls directed at the expected listener location produces the effect of sidewall and rearwall loudspeakers in a home theater setting without any actual sidewall or rearwall loudspeakers. The effect is enhanced by secondary nulls that are directed so as to "reflect" off the front wall of the room toward the expected listener location. Each surround loudspeaker contains an antiphase driver and circuitry including a delay network that powers the drivers to create the skewed hypercardioid sound energy field. The invention is independent of electrical mixing and interaction of two or more input channels. Rather the channels are assumed to be independent and the invention concerns the unique directional sound energy radiation pattern generated from each channel considered independently. An important feature of the skewed hypercardioid sound energy field according to the invention is the insensitivity of the principal null direction to frequency over a range of 120 Hz to 4 kHz.

Also important is a surround sound effect more pronounced in miniature (close range) speaker configurations because the energy gradient between the right and left ears is steeper with the skewed hypercardioid at close range. The invention provides a generalized method of handling direct and reflected sound in an enclosed listening space, since the parameters are variable with delay in the circuitry, the angular relationship of the drivers in the

loudspeaker cabinet and the shape of the cabinet. In some listening configurations only the surround loudspeakers are necessary for superior sound reproduction.

Further to the concept of using the skewed hypercardioid to produce an energy gradient between the listener's right and left ears, a single loudspeaker having a substantially single point source of sound energy from multiple drivers provides a surround sound effect. The surround sound is effective for listeners close to the single loudspeaker or substantially distant within a room. The physical size of the loudspeaker is convenient for placement on top of a computer monitor or television set.

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